

# **Ethylene Oxide (EtO) Emissions: ORD Efforts**

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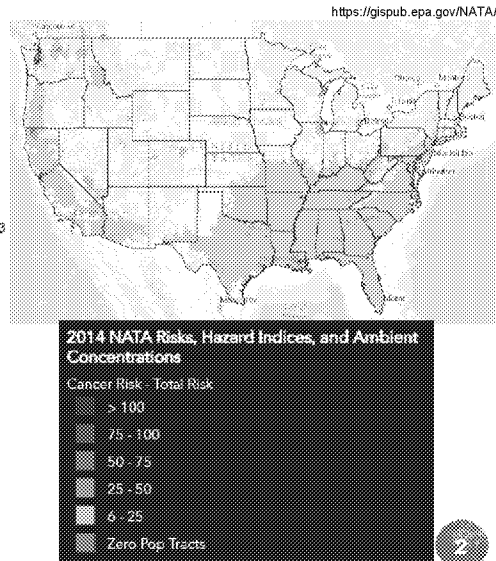


# EtO emissions – suddenly a hot topic?

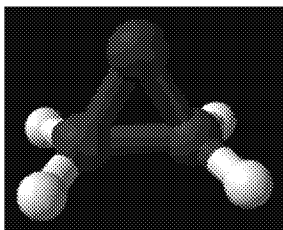
## \* Background:

- \* December 2016, Integrated Risk Information System (IRIS) assessment released for EtO
  - Conclusion - EtO is carcinogenic to humans, issuing an Unit Risk Estimate (URE) ~60 times more potent than previously thought
  - IRIS/NATA/URE cancer risk > 100-in-a-million is  $20 \text{ ng/m}^3$  (~10ppt)
  - National Air Toxics Assessment (NATA) identified roughly 30 EtO-emitting facilities nationwide with cancer risk greater than 100-in-a-million
- \* (released to public in September 2018)
- \* EPA Compendium Method TO-15 (modified) detection limit is  $0.082 \mu\text{g/m}^3$  (~50ppt)

- \* No method to date is sensitive enough to measure at these low levels



## How we get it and what it's used for?



EtO is a colorless, flammable gas with an odor that is faint but sweet

- » Formation:
  - » Occurs from oxidizing ethylene in the presence of a silver catalyst
- » Uses (including but not limited to):
  - » Production of solvents, antifreeze (ethylene glycol), textiles, detergents, adhesives, polyurethane foam, and pharmaceuticals
  - » Low-temperature sterilization processing for food, medical equipment/supplies, and other sensitive materials
- » Emissions:
  - » Uncontrolled emissions from point and area sources?
  - » Fugitive emissions from industrial facilities?
  - » Half-life of ~200 days, unlikely formed in the atmosphere



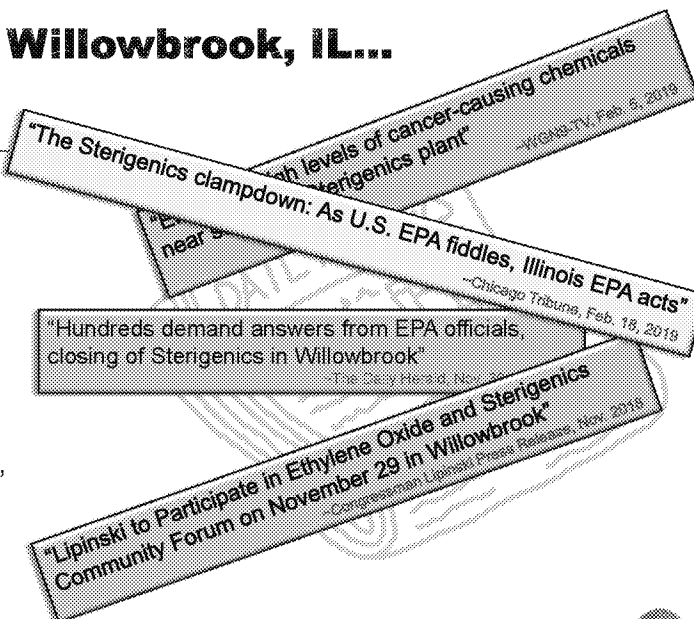
## How did NRMRL get involved?

- \* Region 5 approached OAQPS
  - \* EtO sterilizer at Sterigenics in Willowbrook, IL
  - \* Issue surfaced right before shutdown!
- \* OAQPS approached ORD/NRMRL researchers for help:
  - \* Develop more sensitive measurement technologies and methods
  - \* Emission characterizations for EtO
- \* Region 5 and OAQPS funding to develop instrumentation
  - \* FY19 RARE grant with R5/R6 (\$150K over next two years)
  - \* OAQPS added "seed money" to get started (\$200K to date)
  - \* Instrumentation, methods to measure at the new health risk level – 10ppt
- \* OAQPS funding instrument development Method 301 validation studies (\$100K)
- \* Working now to gain a better understanding of EtO emissions, measurement, and monitoring capability/possibilities



## More background on Willowbrook, IL...

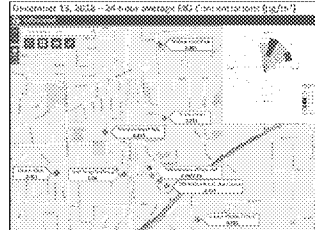
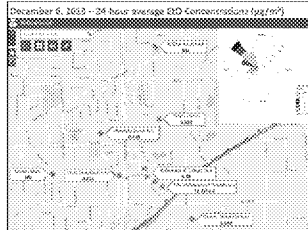
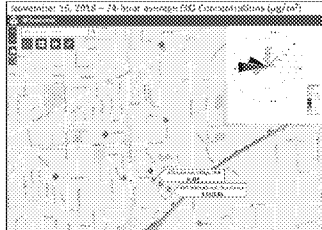
- Sterigenics:
  - EtO sterilizer facility in Willowbrook, IL (Chicago-area)
  - Complying with current regs – test emissions once every 5 years using Method 18
    - Voluntarily collecting TO-15 samples for analysis (but shared emissions data with EPA for comparison)
    - Company attributed elevated emissions of EtO on diesel delivery trucks, which is not supported by emissions data
- So, “Where’s the EtO coming from?”
  - Fugitive, stack, and/or background emissions



## Emissions: fugitive, stack, and background

- \* Illinois EPA issues "Seal Order" for Willowbrook Sterigenics facility
  - \* February 15, 2019
- \* Numbers to remember:
  - \* TO-15 (modified) detection limit is  $0.082\mu\text{g}/\text{m}^3$  (~50ppt)
  - \* IRIS/NATA/URE cancer risk > 100-in-a-million is  $20\text{ ng}/\text{m}^3$  (~10ppt)

Emissions in/around Sterigenics ETO sterilizing facility in Willowbrook, IL



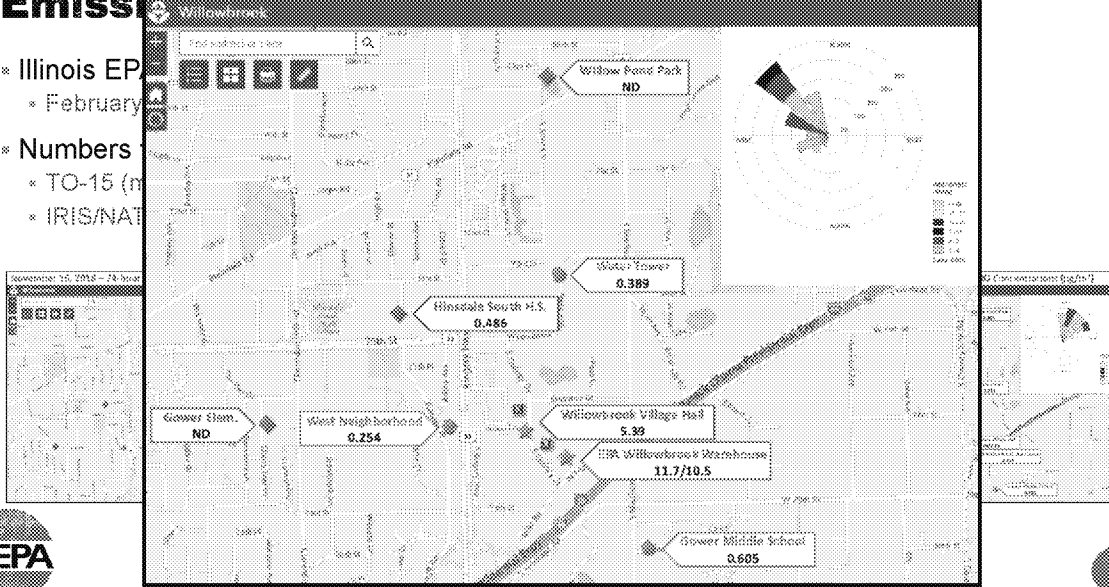
Sampling, data reduction, and data analysis provided by OAQPS and Region 5 (available on EPA website)



# Emission

- \* Illinois EPA
- \* February
- \* Numbers
- \* TO-15 (m
- \* IRIS/NAT

December 6, 2018 ~ 24-hour average EtO Concentrations ( $\mu\text{g}/\text{m}^3$ )



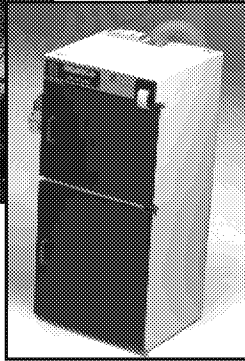
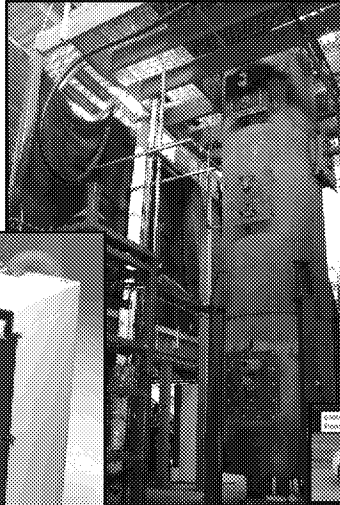
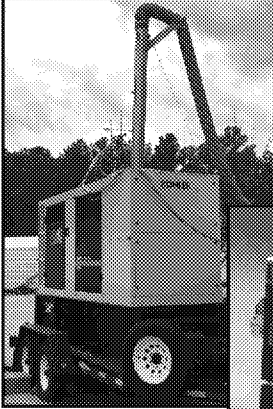
## **ORD Instrumentation and Methods Development**

- \* EPA Compendium Method TO-15
  - \* Contract lab analyzing ambient samples for OAQPS
  - \* ORD considering application to source sampling
  
- \* New low-level measurements for near-source, background emissions (RARE project)
  - \* Online, real-time and semi-continuous sampling
  - \* Testing existing measurement technologies
  
- \* Develop source (stack) measurement instrumentation, techniques, and methods
  - \* Complicated issues – measurement environment
  - \* Ancillary factors like high quality reference gas needs, sampling losses
  - \* Considering multiple technologies and approaches
  - \* Validation studies necessary to identify instruments and methods



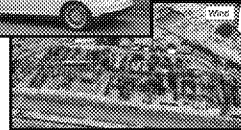
# ORD Emissions Characterization Tools

AEMD's Stationary Diesel Facility (200kW genset)



NHSRC's Laboratory ETO sterilizer

AEMD's Multi-Pollutant Control Research Facility (MPCRF)



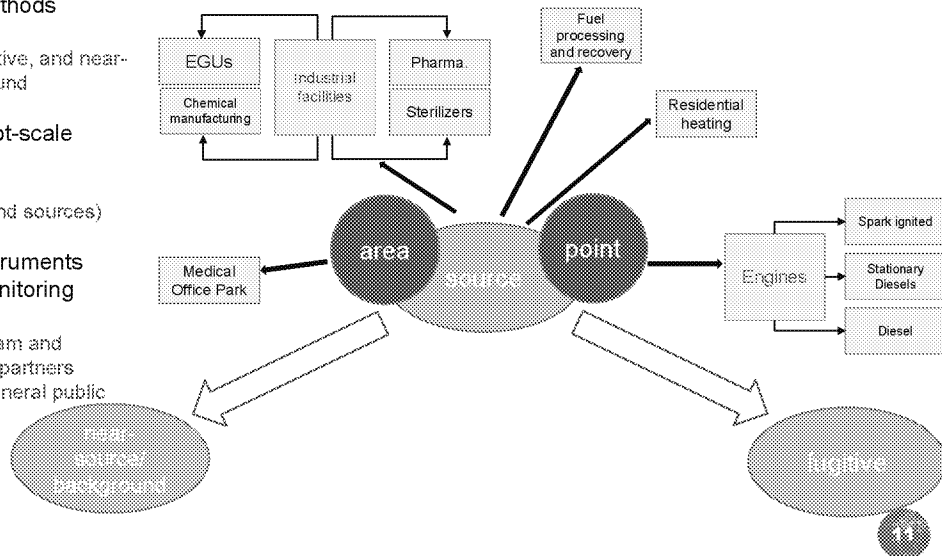
- Laboratory and pilot-scale **source** emissions characterization
  - Stationary diesel genset
  - Multi-Pollutant Control Research Facility (MPCRF)
  - ETO sterilizer
- Field studies
  - Rural and urban settings
  - Near-source
  - Fugitive emissions
- Geospatial measurement of air pollution (GMAP) for source and community impact assessment



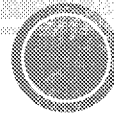
# **Deliberative Process / Ex. 5**

# Where are we going from here?

- \* Instrument and methods development
  - \* For source, fugitive, and near-source/background
- \* Laboratory and pilot-scale testing
  - \* On-site (RTP)
  - \* Off-site (in/around sources)
- \* Field testing of instruments
- \* Measuring and monitoring emissions
  - \* To inform Program and Regional Office partners
  - \* To inform the general public



# ?? Questions??



For further information or more in-depth discussion, please contact us:



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